



Job Description

Summary

Job title	Research Associate on ERC Synergy VePaSS
Division	Mathematical, Physical, and Life Sciences (MPLS)
Department	Computer Science
Location	Wolfson Building, Parks Road, Oxford
Grade and salary	Grade 07RS: £39,424 - £47,779 per annum inclusive of Oxford University weighting Potential to under fill at grade 06RS: £35,681 - £41,636 per annum inclusive of Oxford University weighting
Hours	Full time (37.5 hours per week) – part time can be considered
Contract type	Fixed-term (12 months) with a possibility of renewal
Reporting to	Dr Vincent Cheval
Vacancy reference	188127
Additional information	Whilst the role is a Grade 7RS position, we would be willing to consider candidates with potential but less experience who are seeking a development opportunity, for which an initial appointment would be at Grade 6RS with the responsibilities adjusted accordingly. This would be discussed with applicants at interview/appointment where appropriate.

Research topic	Automated Formal Verification, Stochastic Games, Algebraic Reasoning, Security
Principal Investigator / supervisor	Mahsa Shirmohammadi and Vincent Cheval
Research Project	Verification of Probabilistic Security Systems (ERC Synergy VePaSS)
Funding partner	The funds supporting this research project are provided by European Research Council (ERC)



The role

The post holder will carry out research on the project Verification of Probabilistic Security Systems (VePaSS):

Critical digital infrastructure is increasingly threatened by attacks such as payment fraud, data breaches, and ransomware. Formal methods have been developed to rigorously analyze security protocols, which are the backbone of current digital security. Notably, automated tools, such as ProVerif, have been vital in analysing real-world protocols including TLS and Signal.

A significant limitation in current formal methods stems from abstracting probabilistic behaviours to simplify the analysis. This leads to oversights in cases involving non-negligible probabilities, such as reasoning about distance-bounding protocols and electronic voting. Meanwhile probabilistic verification has been an active field for the past two decades, particularly in relation to cyber-physical systems and network protocols. Verification of security systems does not yet benefit from these advances, yielding a significant blind spot: modern security protocols with probabilistic behaviors and complex threat models remain vulnerable to undetected security flaws.

The VePaSS project aims to build new interdisciplinary connections between security, stochastic games and symbolic computation, to address the ambitious goal of verifying probabilistic security systems. The primary challenge in such an integration is that algorithmic game theory has predominantly concentrated on finite stochastic games, whereas security protocols, when represented symbolically, are inherently infinite. We seek to leverage recent breakthroughs in countable stochastic games and symbolic computation to develop a unified model and to design decision procedures and practical tools for the automatic verification of complex stochastic protocols such as electronic voting and distance-bounding protocols. The project has a strong scientific impact by addressing open problems in verification and symbolic computation, economic impact by enhancing the security of digital systems, and societal impact through its work on electronic voting.

In the context of the VePaSS project, the post holder would have a particular focus on one or more of the following topics:

- Computation of different notions of equilibria in Stochastic games
- Symbolic computation and Algebraic Reasoning
- Reasoning on equivalence of probabilistic security protocols
- Automated Verification through algorithm development

The post holder reports to the Principal Investigators, and provides guidance to junior members of the group, such as PhD students and interns.

Flexible working

The successful candidate will work onsite in the Department of Computer Science buildings in central Oxford, however remote and flexible working can be considered.

Responsibilities

- Manage own academic research and administrative activities. This involves small scale project management, to co-ordinate multiple aspects of work to meet deadlines
- Adapt existing and develop new foundational and applied work, research methodologies and materials
- Contribute ideas for new research projects
- Collaborate in the preparation of research publications
- Present papers at conferences or public meetings
- Act as a source of information and advice to other members of the group on methodologies or procedures
- Represent the research group at external meetings/seminars, either with other members of the group or alone
- Carry out collaborative projects with colleagues in partner institutions, and research groups

Selection criteria

Essential selection criteria

- Hold a relevant PhD/DPhil (or be close to completion*) in theoretical computer science or a related areas of mathematics
- Possess sufficient specialist knowledge in the discipline to work within established research programmes
- Ability to manage own academic research and associated activities
- Previous experience of contributing to publications/presentations
- Ability to contribute ideas for new research projects
- Excellent communication skills, including the ability to write for publication, present research proposals and results, and represent the research group at meetings

*Evidence required:

EITHER a copy of your PhD/ DPhil award certificate;

OR an academic reference confirming the qualification has been awarded;

OR an academic reference confirming that you have submitted your thesis, if you have not yet completed

Desirable selection criteria

- Specific expertise in one or more of the following sub-areas of theoretical computer science and mathematics: automata theory, logic and verification, dynamical systems, number theory, algebra and symbolic computation
- Experience of actively collaborating in the development of research articles for publication

Pre-employment screening

Standard checks

If you are offered the post, the offer will be subject to standard pre-employment checks. You will be asked to provide: proof of your right-to-work in the UK; proof of your identity; and (if we haven't done so already) we will contact the referees you have nominated. If you have previously worked for the University we will also verify key

information such as your dates of employment and reason for leaving your previous role with the department/unit where you worked. You will also be asked to complete a health declaration so that you can tell us about any health conditions or disabilities for which you may need us to make appropriate adjustments.

Please read the candidate notes on the University's pre-employment screening procedures at:

<https://www.ox.ac.uk/about/jobs/explore-our-careers/applications-process/pre-employment-screening>

About the University of Oxford

Welcome to the University of Oxford. We aim to lead the world in research and education for the benefit of society both in the UK and globally. Oxford's researchers engage with academic, commercial and cultural partners across the world to stimulate high-quality research and enable innovation through a broad range of social, policy and economic impacts.

We believe our strengths lie both in empowering individuals and teams to address fundamental questions of global significance, while providing all our staff with a welcoming and inclusive workplace that enables everyone to develop and do their best work. Recognising that diversity is our strength, vital for innovation and creativity, we aspire to build a truly diverse community which values and respects every individual's unique contribution.

While we have long traditions of scholarship, we are also forward-looking, creative and cutting-edge. Oxford is one of Europe's most entrepreneurial universities and we rank first in the UK for university spin-outs, and in recent years we have spun out 15-20 new companies every year. We are also recognised as leaders in support for social enterprise.

Join us and you will find a unique, democratic and international community, a great range of staff benefits and access to a vibrant array of cultural activities in the beautiful city of Oxford.

For more information, please visit <https://www.ox.ac.uk/about>.

Department of Computer Science

The Department of Computer Science is consistently recognised as the internationally leading centre of research and teaching across a broad spectrum of computer science. We are proud of our history as one of the longest-established computer science departments in the country, as we continue to provide first-rate undergraduate and postgraduate teaching to some of the world's brightest minds.

Our world-class research is conducted across our research themes, which span the broad spectrum of computer science, ranging from foundational discoveries to interdisciplinary work with significant real-world impact. A significant majority of our staff are active in externally sponsored research, with both government and industrial funding. Our 2021 Research Excellence Framework submission saw 81% of our research activity ranked as world-leading (4*), with the rest ranked as internationally excellent (3*). We have had 19 ERC Fellowships in the last decade (including 7 Advanced) and we have 6 Fellows of the Royal Society, 4 Turing/Turing AI Fellows, a Fellow of the Royal Academy of Engineering and a Fellow of the Institute of Electrical and Electronics Engineers.

We enjoy close links with other Oxford University departments (Mathematics, Engineering, Physics, Statistics and Life sciences) and work collaboratively with Oxford research groups and institutes (including the Oxford Internet Institute and the Oxford e-Research Centre). At present, the department has 71 faculty members and 98 researchers housed across multiple sites within the University's South Parks Road Science Area and the neighbouring area. Through a programme of continuous improvement, the department is committed to promoting and nurturing a diverse, inclusive and equal culture, with a particular focus on growth in gender equality (from our students to our staff).

The department holds over £75m of external funding of which £58m is research. Research in the department is currently managed in ten themes:

- *Algorithms & Complexity Theory*, led by Professor Leslie Ann Goldberg, focusses on determining the inherent difficulty of computational problems, classifying problems according to this inherent difficulty, and designing and analysing algorithms that use computational resources as efficiently as possible;

- *Artificial Intelligence & Machine Learning*, led by Professor Michael Wooldridge, focuses on theoretical foundations of AI, multi-agent systems, deep learning, reinforcement learning, and computational linguistics;
- *Automated Verification*, led by Professor Marta Kwiatkowska, investigates theory and practice of formal verification and correct-by-construction synthesis for software and hardware systems;
- *Computational Biology & Health Informatics*, led by Professor Blanca Rodriguez, is concerned with computational approaches for biomedical research and healthcare innovation;
- *Human-Centred Computing*, led by Professor Nigel Shadbolt, includes human-computer interaction, social computing, and the worldwide web;
- *Data and Knowledge & Action*, led by Professor Ian Horrocks, includes databases, knowledge representation and reasoning;
- *Programming Languages*, led by Professor Nobuko Yoshida, includes functional programming, program analysis, and programming language foundations;
- *Quantum*, led by Professor Jonathan Barrett, focusses on quantum computing including quantum software, causality in quantum theory, quantum cryptography and foundations of quantum computing;
- *Security*, led by Professor Ivan Martinovic, specialises in cybersecurity, protocol analysis, systems security, trusted computing, and networking.
- *Systems*, led by Professor Niki Trigoni, focusses especially on cyber physical systems. We plan to substantially broaden our research in systems to complement our existing research areas.

Our greatest asset is our people. We consistently attract the best staff and students, and thanks to them, we have been ranked as the world's leading university for Computer Sciences for eight years in a row by the *Times Higher Education*. We have held an Athena Swan Bronze Award since 2014, reflecting our longstanding commitment to promoting and supporting gender equality.

Find out more information on our website <https://www.cs.ox.ac.uk/>

Mathematical, Physical, and Life Sciences Division

The Mathematical, Physical, and Life Sciences (MPLS) Division is one of the four academic divisions of the University. Oxford is widely recognised as one of the world's leading science universities and the MPLS Division is home to our non-medical sciences, with 9 academic departments that span the full spectrum of the mathematical, computational, physical, engineering and life sciences, and undertake both fundamental research and cutting-edge applied work.

For more information about the MPLS division, please visit: www.mpls.ox.ac.uk

How to apply

Applications are made through our online recruitment portal. Information about how to apply is available on our Jobs website <https://www.ox.ac.uk/about/jobs/explore-our-careers/applications-process/how-to-apply>

Your application will be judged solely on the basis of how you demonstrate that you meet the selection criteria stated in the job description.

As part of your application you will be asked to provide details of two referees and indicate whether we can contact them now.

You will be asked to upload a CV and a supporting statement. The supporting statement must explain how you meet each of the selection criteria for the post using examples of your skills and experience. This may include experience gained in employment, education, or during career breaks (such as time out to care for dependants)

Please upload all documents **as PDF files** with your name and the document type in the filename.

All applications must be received by **midday** UK time on the closing date stated in the online advertisement.

Information for internal candidates

If you currently work at the University please note that:

- as part of the referencing process, we will contact your current department to confirm basic employment details including reason for leaving and information about your performance.
 - although employees may hold multiple part-time posts, they may not hold more than the equivalent of a full time post. If you are offered this post, and accepting it would take you over the equivalent of full-time hours, you will be expected to resign from, or reduce hours in, your other posts(s) before starting work in the new post.
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Information for priority candidates

A priority candidate is a University employee who is seeking redeployment because they have been advised that they are at risk of redundancy, or on grounds of ill-health/disability. Priority candidates are issued with a redeployment letter by their employing department(s).

If you are a priority candidate, please ensure that you attach your redeployment letter to your application (or email it to the contact address on the advert if the application form used for the vacancy does not allow attachments).

If you need help

Application FAQs, including technical troubleshooting advice is available at:

<https://www.ox.ac.uk/about/jobs/explore-our-careers/applications-process/support-with-online-applications>

Non-technical questions about this job should be addressed to the recruiting department directly hr@cs.ox.ac.uk.

To return to the online application at any stage, please go to: <https://www.ox.ac.uk/about/jobs/explore-our-careers/applications-process/how-to-apply>

Please note that you will receive an automated email from our online recruitment portal to confirm receipt of your application. **Please check your spam/junk mail** if you do not receive this email.

Important information for candidates

Data Privacy

Please note that any personal data submitted to the University as part of the job application process will be processed in accordance with the GDPR and related UK data protection legislation. For further information, please see the University's Privacy Notice for Job Applicants at: <https://compliance.admin.ox.ac.uk/job-applicant-privacy-policy>. The University's Policy on Data Protection is available at: <https://compliance.admin.ox.ac.uk/data-protection-policy>.

The University's policy on retirement

The University operates an Employer Justified Retirement Age (EJRA) for very senior research posts at **grade RSIV/D35 and clinical equivalents E62 and E82** of 30 September before the 70th birthday.

For **existing** employees on these grades, any employment beyond the retirement age is subject to approval through the procedures: <https://unioxfordnexus.sharepoint.com/sites/OXINTRANET-working-here/SitePages/the-ejra.aspx>

There is no normal or fixed age at which staff in posts at other grades have to retire. Staff at these grades may elect to retire in accordance with the rules of the applicable pension scheme, as may be amended from time to time.

Equal Opportunity

The University of Oxford is committed to equal opportunity, and to being a place where everyone belongs and is supported to succeed. We recognise how the diversity of our community enriches our ability to deliver on our academic mission.

We welcome applications from individuals from all backgrounds, including those under-represented within higher education. No applicant or members of staff shall be unlawfully discriminated against on the basis of age, disability, gender reassignment, marriage or civil partnership, pregnancy or maternity, race, religion or belief, sex, or sexual orientation.

Employment with the University and progression within employment will be determined according to personal merit and the application of criteria related to the duties and conditions of the post. In all cases, the primary consideration will be the ability to perform the job.

As stated in the University's Equality Policy and Equality, Diversity and Inclusion Strategic Plan, our commitment to equality and diversity goes hand in hand with our commitment to academic freedom and free speech.

Benefits of working at the University

Employee benefits

University employees enjoy 38 days' paid holiday, generous pension schemes, flexible working options, support for sustainable travel and other discounts. Staff can also access a huge range of personal and professional development opportunities. See <https://www.ox.ac.uk/about/jobs/working-here>.

Employee Assistance Programme

As part of our wellbeing offering staff get free access to a confidential employee assistance programme, available 24/7 for 365 days a year. Find out more at <https://www.ox.ac.uk/about/jobs/life-in-oxford/healthcare-and-wellbeing>

University Club and sports facilities

Membership of the University Club is free for University staff. It offers social, sporting, and hospitality facilities. Staff can also use the University Sports Centre on Iffley Road at discounted rates, including a fitness centre, powerlifting room, and swimming pool. See www.club.ox.ac.uk and <https://www.sport.ox.ac.uk/>.

Information for staff new to Oxford

Please see our Life in Oxford webpage for information on relocating to and settling into the Oxford area. The website offers valuable guidance, including information on where to find more details about housing, transportation, finances, healthcare, and other key aspects of living in Oxford and the surrounding region. See <https://www.ox.ac.uk/about/jobs/life-in-oxford>

There is also a visa loan scheme to cover the costs of UK visa applications for staff and their dependants. See <https://www.ox.ac.uk/about/jobs/explore-our-careers/applications-process/visas-and-immigration>

Family-friendly benefits

We are a family-friendly employer with one of the most generous family leave schemes in the Higher Education sector (see <https://www.ox.ac.uk/about/jobs/explore-our-careers/applications-process/terms-and-conditions-of-employment>). Our Childcare Services team provides guidance and support on childcare provision, and offers a range of high-quality childcare options at affordable prices for staff. In addition to 5 University nurseries, we partner with a number of local providers to offer in excess of 450 full time nursery places to our staff. Eligible parents are able to pay for childcare through salary sacrifice, further reducing costs. See <https://www.ox.ac.uk/about/jobs/life-in-oxford/childcare-and-schooling/childcare>

Supporting disability and health-related issues

We are committed to supporting members of staff with disabilities or long-term health conditions, including those experiencing negative effects of menopause. Information about the University's Staff Disability Advisor, is at <https://edu.admin.ox.ac.uk/support-for-disabled-staff>. The Staff Disability Advisor can be contacted at staffdisability@admin.ox.ac.uk

The University of Oxford Newcomers' Club

The University of Oxford Newcomers' Club is run by volunteers that aims to assist the partners of new staff settle into Oxford, and provides them with an opportunity to meet people and make connections in the local area. See www.newcomers.ox.ac.uk

Research staff

The Researcher Hub supports all researchers on fixed-term contracts. They aim to help you settle in comfortably, make connections, grow as a person, extend your research expertise and approach your next career step with confidence. Find out more <https://www.ox.ac.uk/research/support/researcher-hub/about>